



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject:	<u>INFORMATION</u> :, Equivalent Level of Safety Finding (ELOS) for Boeing 747 Series Aircraft regarding the calculation of static interface loads	Date:	January 26, 2004
From:	Manager, Transport Airplane Directorate, Airframe/Cabin Safety, ANM-115	Reg Ref	§ 25.561
		Reply to	Dorr Anderson,
		Attn. of:	ANM-150S
To:	Manager, Seattle ACO	ELOS	TD6633SE-T-C-1
		Memo #	

The purpose of this memorandum is to inform the certificate management certification office of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for Boeing Model 747 Series Aircraft.

Background

In 1957, industry established National Aerospace Standard (NAS) 809 defining the seated passenger center of gravity (CG) of 10.5" above the seat reference point. Since that time, industry and the FAA have utilized this 10.5" passenger CG height for demonstrating compliance to airworthiness requirements.

In practice, the FAA had historically relied upon the industry standard of NAS 809 as an acceptable method of compliance to § 25.561(b)(3)(ii), however the FAA had not documented this approach as formal policy until 1987.

Federal Aviation Administration (FAA) policy memorandum, "Location of Passenger Center of Gravity Above the Compressed Seat Cushion for Compliance With § 25.561 and TSO-C39," dated November 23, 1987 states:

The only document directly approved by the FAA which specifies Center of Gravity (CG) locations for static testing of passenger seats is NAS 809. It has only recently come to our attention that Designated Engineering Representatives (DERs) have approved documents which specify CG locations different from those in NAS 809. We are correcting this interpretation of the rules by informing all certification offices and all DERs to use 10.5 inches for the vertical CG location.

The static load conditions specified in § 25.561 are intended to provide an acceptable level of safety when applied using the TSO C39 (NAS 809) body block. The FAA considers a vertical CG location 10.5 inches above the base of the NAS 809 body block acceptable for use in showing compliance with the static test requirements of § 25.561.

Applicable Regulations

§ 25.561, TSO-C39

Regulation(s) Requiring an ELOS

§ 25.561(b)(3)(ii)

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations, or equipment needed for equivalency)

The intent of § 25.561 is as stated in the entire regulation including the requirement to protect each occupant when exposed to the specific load conditions prescribed within § 25.561(b)(3). However, 33 years of service history indicates that the design of the Model 747 meets the intent of the regulation for protecting occupants in survivable accidents.

In the area of airplane design factors and size effects on crash loads, the FAA agrees that loads that are experienced by each occupants may be reduced in some cases for wide body airplanes as compared to narrow body airplanes for a minor crash landing, everything else being equal. While it is logical that the overall size of the 747 and the size of the crush-zone of the lower fuselage may be significant factors in reducing the load experienced by an occupant on the main and upper deck of the 747, other factors inherent to the 747 design may also contribute.

It must be noted, however, that since compensating features are required to be features of the type design, service experience, as used in this context, substitutes for tests or qualifications. Service experience, in and of itself, is not a substitute for compliance with a rule.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

Based upon data provided, the FAA agrees that the Model 747 merits a finding of equivalent safety for § 25.561(b)(3)(ii). However, rather than reduce the passenger CG height, the industry standard for establishing the seated passenger CG, in effect 10.5 inches above the seat reference point, shall be used for all cases while an emergency forward load factor of 6.0g may be used for calculating track bending only based on the vertical load component from passenger seats for all models of the 747. All other calculations of load in accordance with § 25.561(b)(3)(ii) shall be performed based on a 9.0g load factor and the industry standard for establishing the seated passenger CG.

The FAA fully expects that all new and amended type certification programs and reconfigurations of other (non-747) existing models will be conducted using the methodology identified in the 1987 FAA memorandum or other compliance methodology formally agreed to by the FAA.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding addressed in issue paper C-1. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Airplane Directorate has assigned a unique ELOS Memorandum number to facilitate archiving and retrieval of this ELOS. This number should be listed in the Type Certificate Data Sheet in the Certification Basis section as a statement for a TC or ATC project or on page 3 of the STC for an STC project. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):
§ 25. 561 Emergency Landing Dynamic Conditions (documented in TAD ELOS Memo TD6633SE-T-C-1)

/s/ Franklin Tiangsing

Manager, Airframe/Cabin Safety Branch, ANM-115

January 26,
2004

Date

ELOS Originated by Seattle ACO:	Project Engineers: Robert E. Kaufman, Shannon Lennon, and Victor Wicklund	Routing Symbol ANM-150S
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